Exchanging PMESII Data to Support the Effects-Based Approach (EBA) to Operations

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Outline

- **Stability Operations**

- **Effects Based Approach to Operations**

- **Joint Consultation, Command and Control Information Exchange Data Model (JC3IEDM)**

- **State of the Art Simulations**

- **Illustrative Urban Scenario**

- **Addressing JC3IEDM Taxonomy**

- **Multinational Federation**

- **Exchanging Commander's Intent**

- **Future Work**

- **Conclusions**

Introduction

Problem:

**Today's virtual environments focus chiefly on attrition and the causal effects associated with kinetic interactions.**

Premise:

By using simulations to generate new data types that support non-kinetic aspects of Stability Operations (SO) and Effects-Based Approach (EBA), C4ISR developers can use this data for improving their components to better serve the warfighter.

Stability Operations

- **Stability Operations (SO) are required, even after achieving political goals.**

Reduce the Likelihood of Reemergence

Solve the Crisis

INSTABILITY
CRISIS
CRISIS RESOLUTION
ROOT CAUSES

- **Reconstruction**
  - **Provide security**
  - **Humanitarian assistance**
  - **Limited governance**
  - **Restore public services**

- **Goal: Facilitate transition to a local civil governance.**
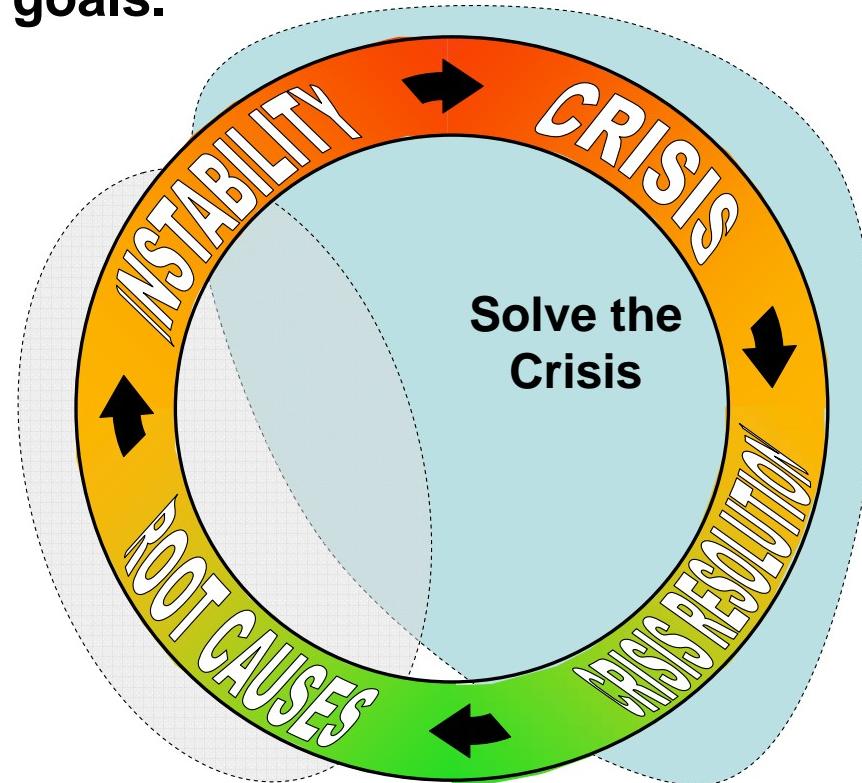
PmESII Operational Environment

Adversary and Coalition National Power

Information

Vulnerabilities

Political

Military

Infrastructure

Social

Links

Strengths

Elements

Economic

Weaknesses

Relationships
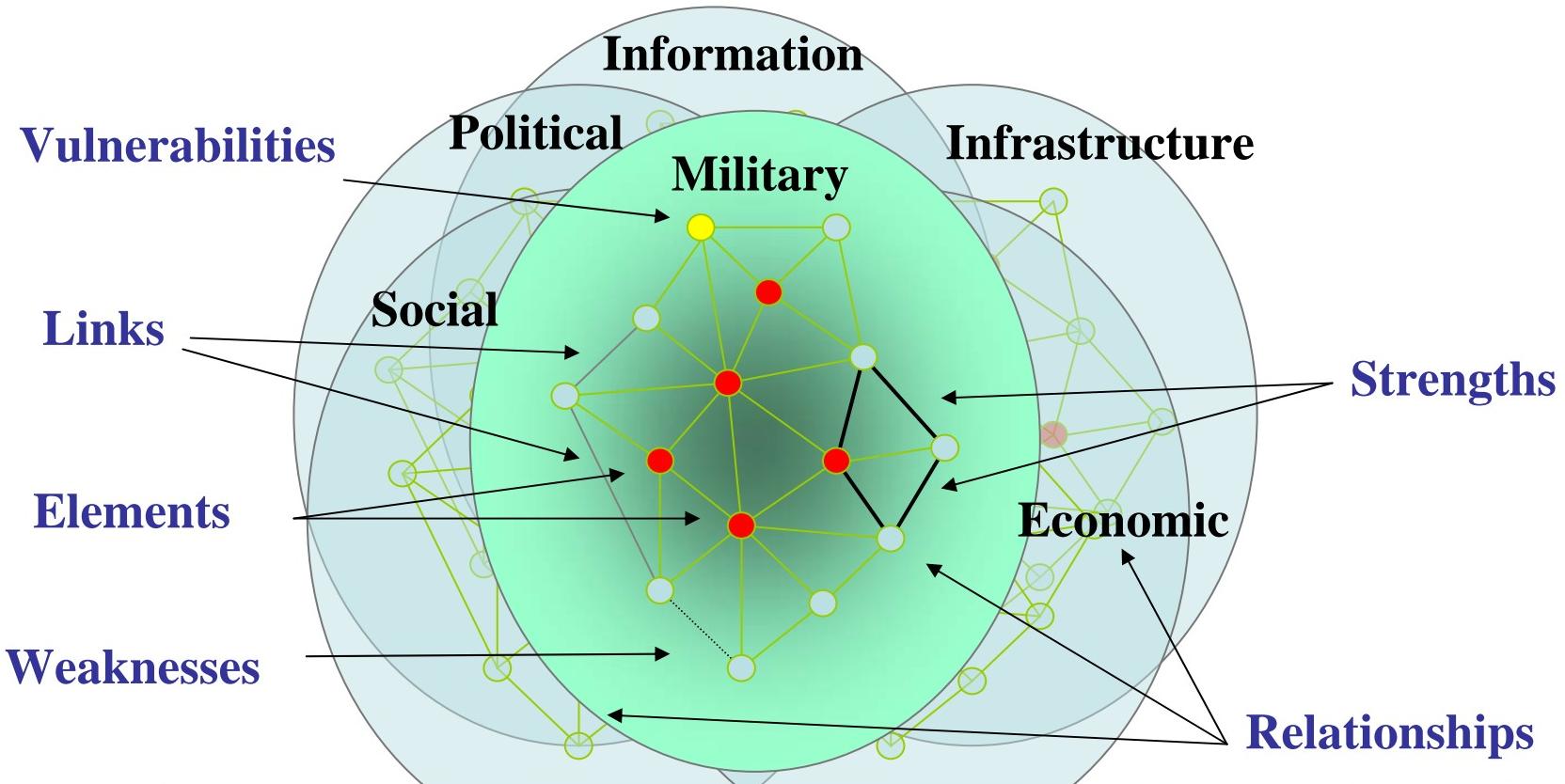
Today's **adversary is a** *dynamic, adaptive* **foe who operates within a** *complex, interconnected* **operational environment.**

Effects-Based Approach to Operations

Changing the Way We Think ...

Objective

Destroy Global Terrorist Networks

PMESII Elements

Actions

Diplomatic
(build & sustain coalition)

Information
("not a war on Islam" message)

Military
(remove Taliban regime)
(destroy terrorist cells)

Economic
(cut off funding)

Resources

Integrated **DIME** Actions

Effects

Key Elements & Vulnerabilities
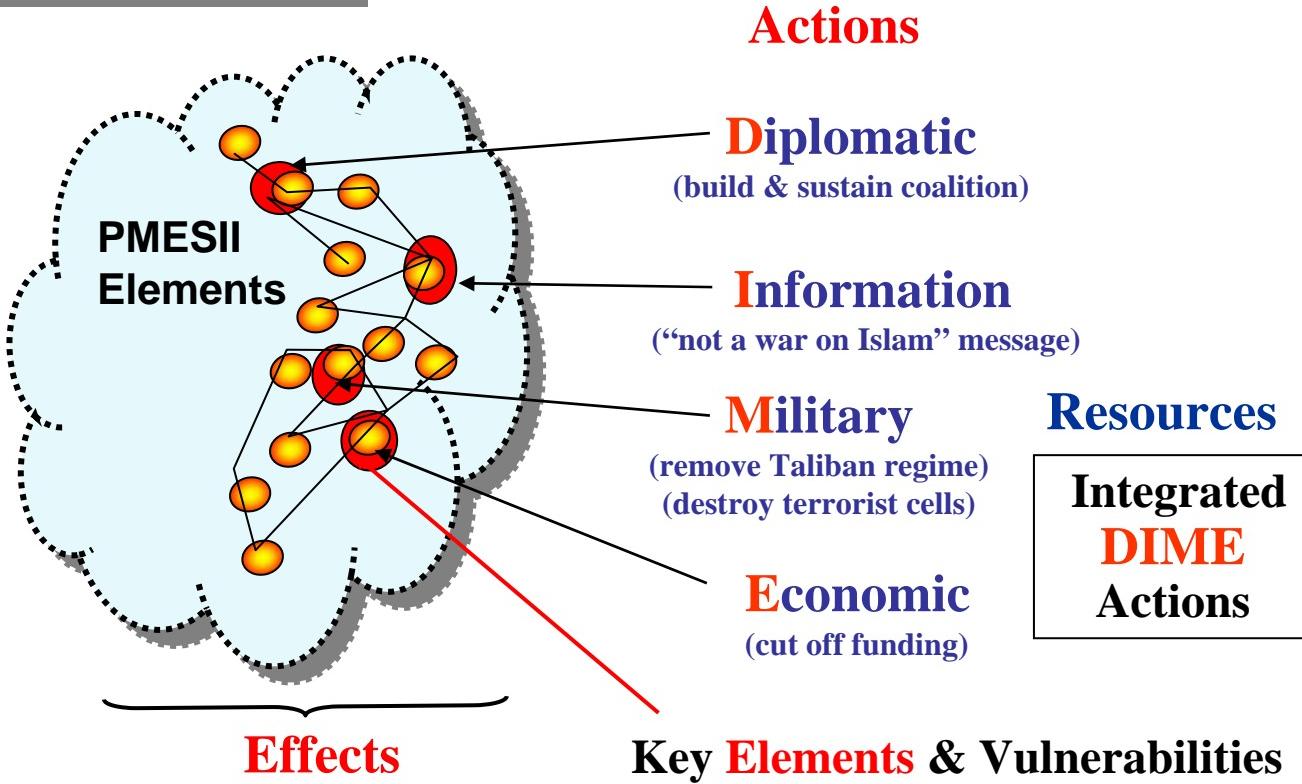
What has to happen to Red to achieve Blue objectives
(no longer able to operate as an adaptive network with global reach)

Instruments of national power: DIME = Diplomatic, Information, Military & Economic 5

JC3IEDM

- **JC3IEDM is an evolving data specification to enable information exchanges among national command and control systems.**

- **Represents years of data modeling efforts under the administrative management of the Multilateral Interoperability Program.**

- **JC3IEDM is the result of the merging of Command and Control Information Exchange Data model (C2IEDM) and the NATO Corporate Data Model (NCorpDM).**

- **Significance of JC3IEDM is highlighted as the U.S. Army recently adopted C2IEDM as the standard for information exchanges among command and control applications.**

- **Leveraging years of cooperation from among dozens of participating nations and organizations, JC3IEDM has the potential to become a truly robust information repository to support combined joint operations.**

State of the Art Modeling

- **Attrition simulations synchronize on causal effects to model conventional combat operations.**

- **Processes of acquiring and engaging entities in the virtual environment are modeled as independent and explicit occurrences, enabling a quantified comparison of engagement protocols.**

- **Military organizations and civilian populations are represented for target identification and measure effectiveness of kinetic actions against targets.**

- **Behavior of civilian populations and reactions of the population to kinetic actions are subject to an operator's discretion.**

State of the Art Modeling

- **Joint Semi-Automated Forces (JSAF):**
  - Federation of simulations, uses High Level Architecture (HLA).
  - **CultureSim:**
    - Light-weight model of movement in urban environment.
    - Pedestrians & vehicles.
  - **Dynamic Terrain Simulation (DTSim):** Collateral damage & building repairs.
  - **ModStealth:** 3D visualization.

- **SEAS: Synthetic Environments for Analysis and Simulation**
  - **Virtual International System (SEAS-VIS):**
    - Intra and inter-nation dynamics, leaders.
    - Citizens' expectations, goals, and desires for well-being.
  - **Near Real-Time (SEAS-NRT):** Irregular actions of individuals.

Illustrative Urban Scenario

- **Demonstrates that population mood and subsequent behavior are influenced by kinetic actions.**

- **Urban area was divided into two regions.**

- **People initialized as neutral with regards to both Foreign Security Forces (FSF) and insurgencies.**

- **Explosions caused building damage, representing local events that influence the population.**

- **Building repairs represent actions taken by military decision makers in support of SO.**

- **Population perceived all detonations and repairs as related to the presence of FSF.**

- **Civilian behavior surfaced in the formation of curious or volatile crowds.**

Hostile Environment
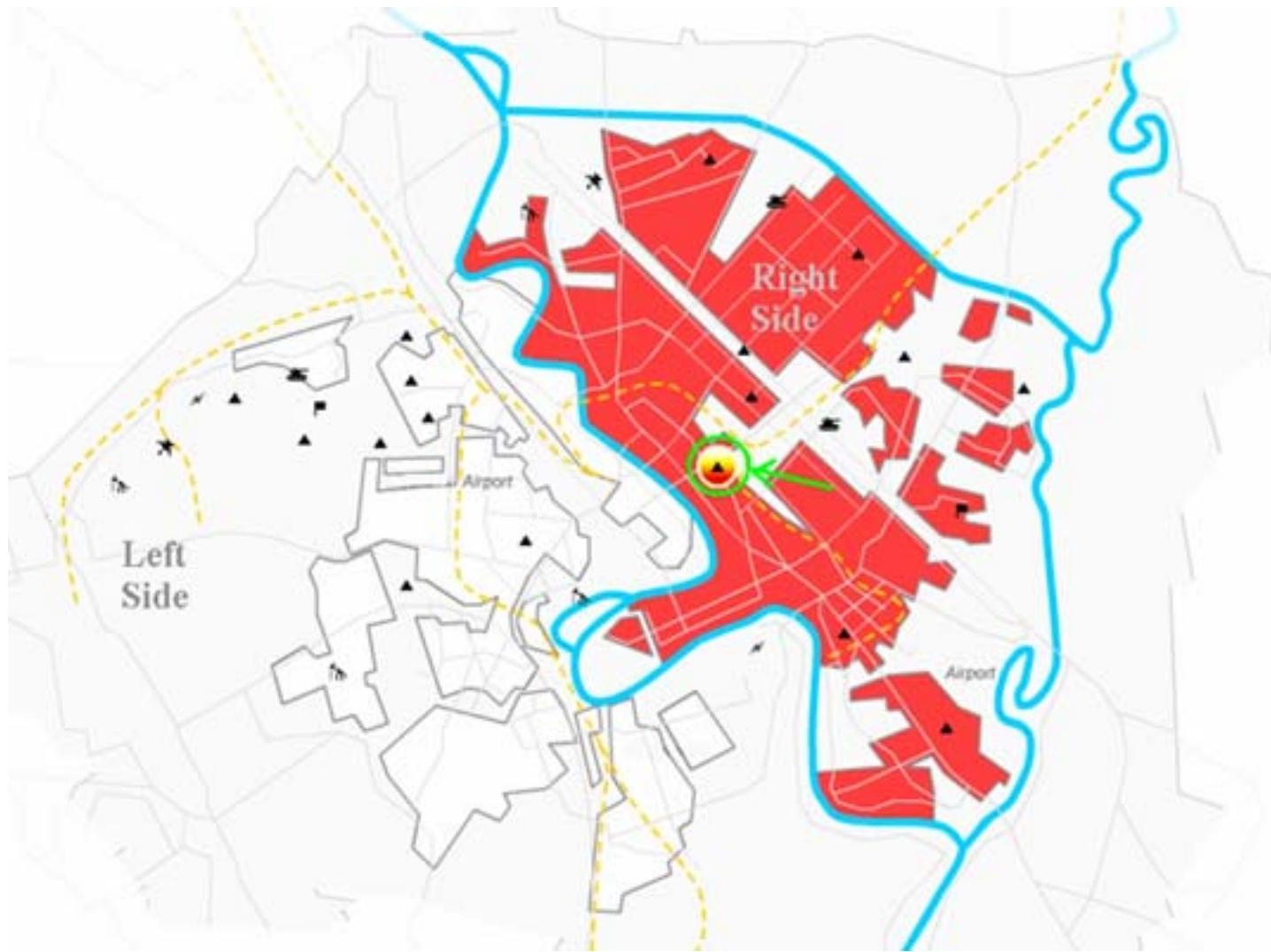
Hostile Environment
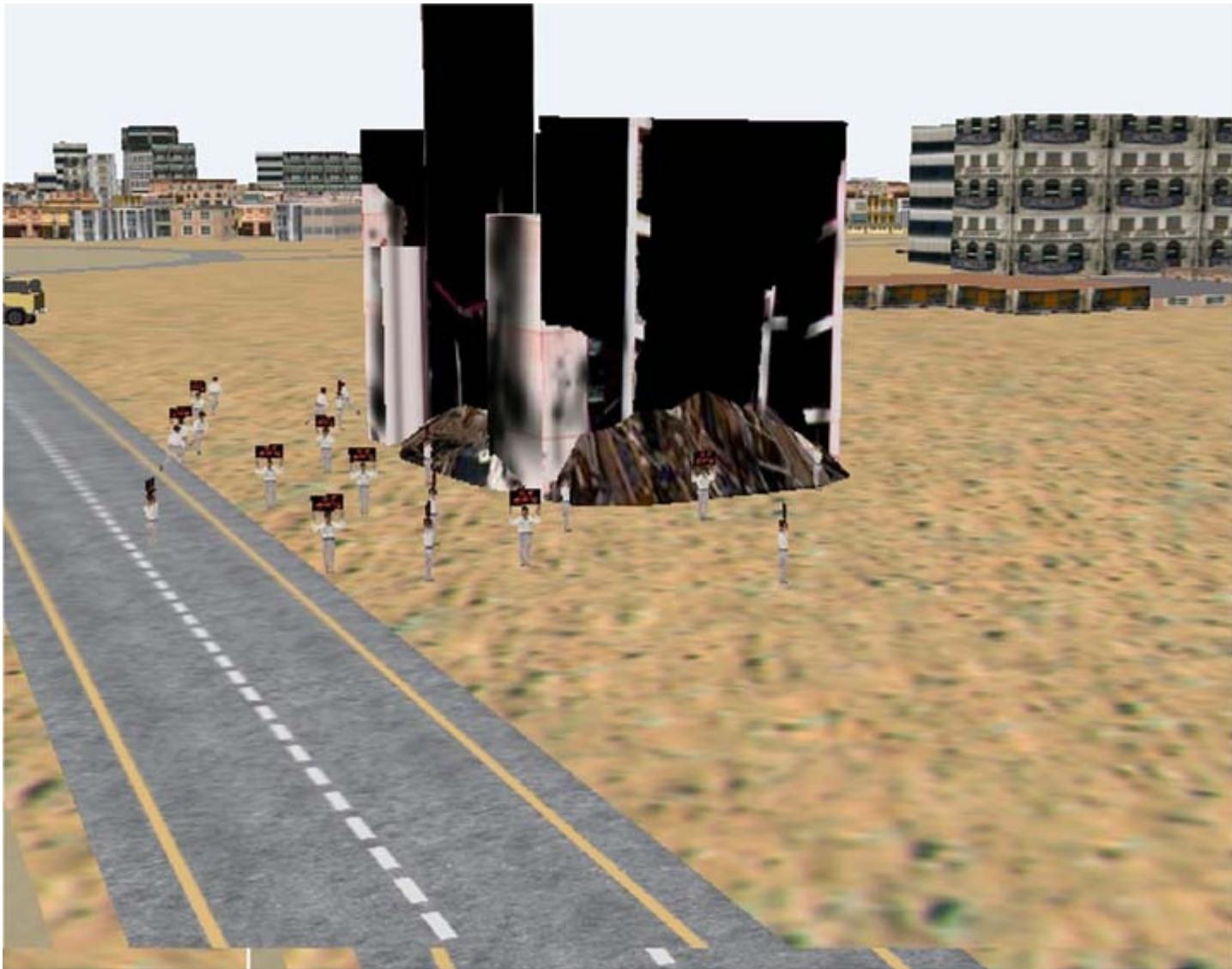
Addressing JC3IEDM Taxonomy

- **Within the JC3IEDM data specification, the entity is the basic concept.**

- **Different attributes among the 194 JC3IEDM entities allow them to be distinguishable, 15 are stand alone entities and are grouped into information concepts.**

- **Of the JC3IEDM's five fundamental information concepts, two are central for discussions to extend the model for EBA:**

  - **Object-type**
  - **Object-item**

Addressing JC3IEDM Taxonomy
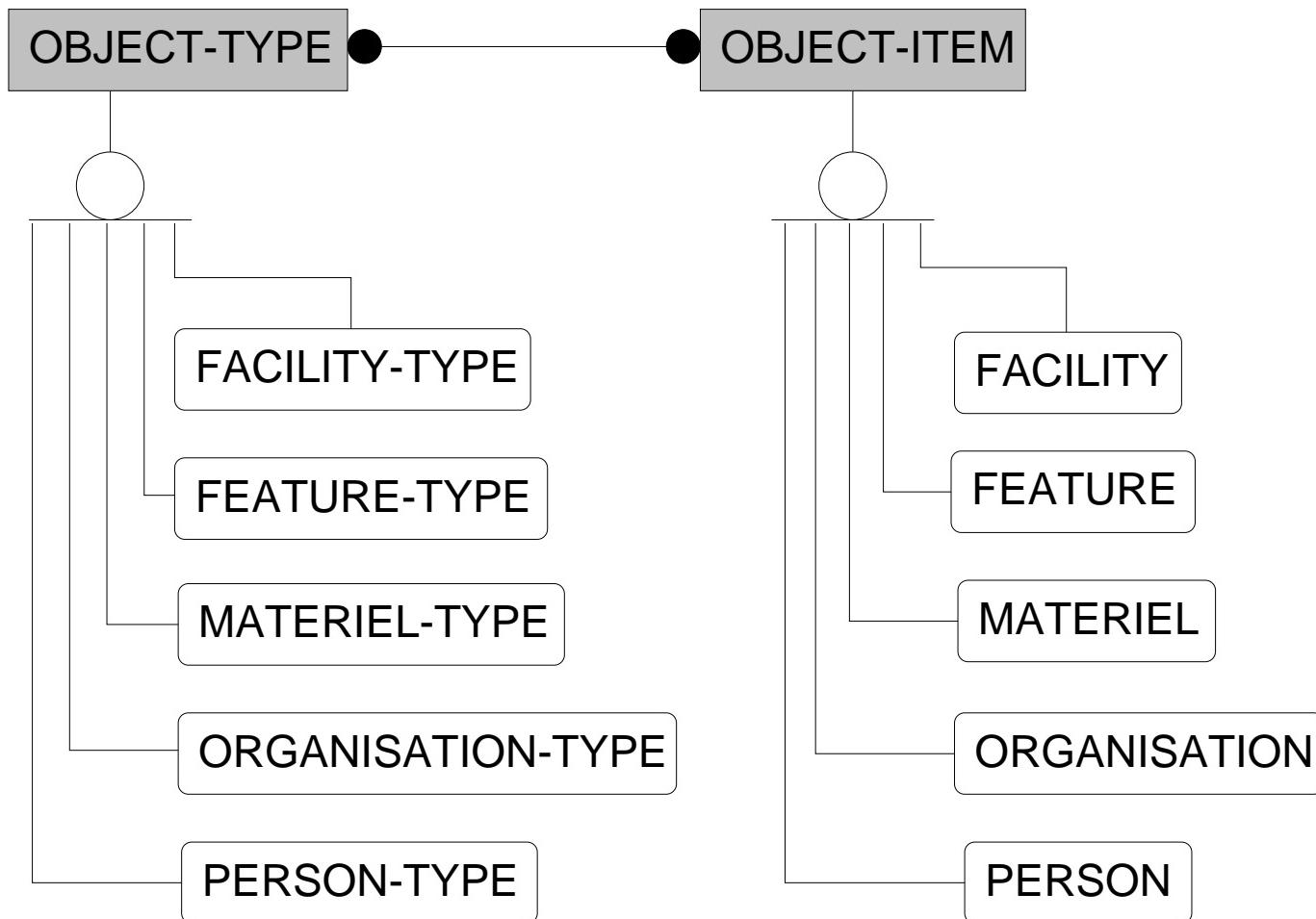
Addressing JC3IEDM Taxonomy

- **Associated with the measure of effectiveness for stability are seven normality indicators.**

- **Some of these indicators map directly to the JC3IEDM topic area of Environment Conditions – Civil.**

- **Within this topic area, there are several related IERs known as the Peacetime Support Operations that later evolved into the Crisis Response Operations (CRO).**

- **This set of IERs was created from the information exchange needs to coordinate and integrate the joint use of lethal and non-lethal assets, which extended earlier terrestrial-centric versions of the JC3IEDM like the C2IEDM.**

Addressing JC3IEDM Taxonomy

- A **taxonomy** consists of a tree classification for an established set of objects usually starting at a **single classification** that relates together all other objects.

- Based on the identified need for CRO, the **object-type** can be considered the **root node** for extending the JC3IDEM from a kinetic to a non-kinetic realm.

- Since each CRO IER is supported by corresponding **operational level message types**, then these IERs serve as a method to exchange information on non-kinetic objects.

- Additionally, it is possible to relate selected object subtypes to the previously mentioned **illustrative scenario** and CRO IERs.

Addressing JC3IEDM Taxonomy

- **JSAF represents the kinetic simulation aspects of the battle-space by rendering crowds that display well-being as either anger or curiosity.**

- **Person-type represents regional, ethics and demographic characteristics of populations, JC3IEDM can be a means to relate these characteristics to a virtual crowd.**

- **Since crowds' respective moods can be visualized in a virtual environment, then the region's general state of well-being can be inferred by inspection.**

- **Crowd formations can be identified under the organization-group to provide indicators of potential demonstration or riot formations due to the leaders influence and the mood of the region.**

- **Thus via a combination of object-type specifications can capture simulation generated data that models different types of population groups and their perceived well-being.**

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Addressing JC3IEDM Taxonomy

- **Simulations can generate visual cues to emulate battle-field assessments of the progress of actions to achieve that desired end state.**

- **Many of these EBA assessments can be transmitted via the reporting-data and its subtypes specification that captures temporal status updates and the reporting source information.**

- **The observed well-being of a region is not easily transmitted via the reporting-data specification in the JC3IEDM.**

- **A method to display perceived well-being is the user graphics attributes as specified in the feature-type specification.**

- **User graphic features, such as lines and overlays with differentiating color shaded regions, can capture simulation generated data.**

Addressing JC3IEDM Taxonomy
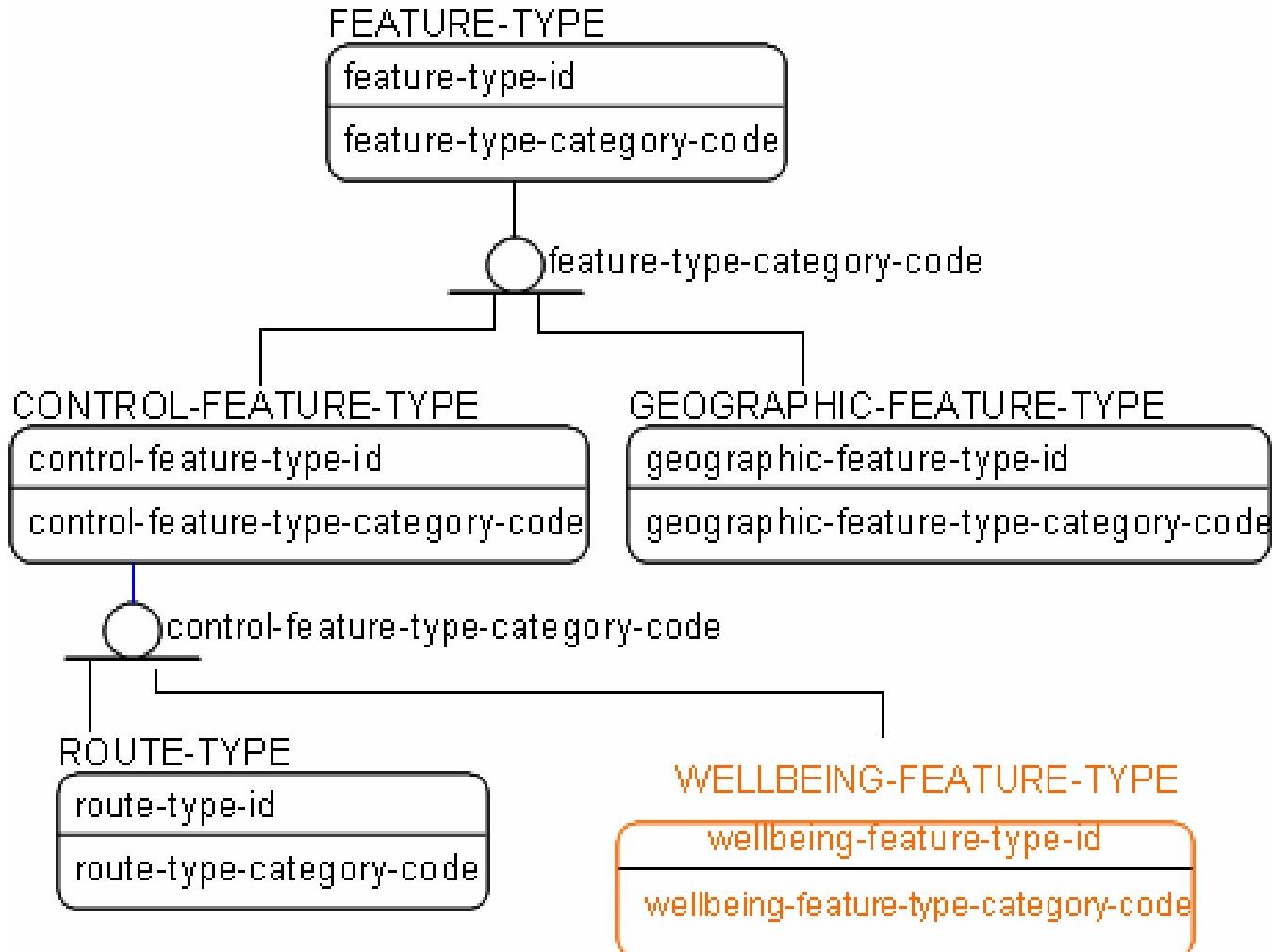
Multinational Federation

- **A major J9 experiment to investigate EBA was Multinational Experiment 4 (MNE4).**

- **MNE4's aim was to explore concepts and supporting technologies for EBA within a coalition environment involving SO with increasing levels of violence to assist the development of future processes and tools at the operational level of command.**

- **Simulating the characteristics and traits of battle-field entities was necessary to enable the stimulation of C4ISR systems.**

- **Simulations parsed data into structured messages formats to emulate unit location and status reporting by stimulating the Common Operational (COP).**

- **Web-enabled components of the Global Command and Control System (GCCS) allowed remote international users situational awareness and situational understanding (SA/SU).**

Multinational Federation

- **Four constructive simulations** provided the MNE4 virtual environment:

    - Previously mentioned kinetic JSAF and non-kinetic SEAS

    - France's ALLIANCE (Application Logciele InterArmees Nationale pour l'entainement Au Commandement d'un Engagement militare)

    - Germany's JOANA (Joint Operations Army, Navy, Air Force).

- ALLIANCE, JOANA and JSAF used **bridges** to send emulated message traffic to the GCCS server.

- All three kinetic simulations stimulated **GCCS with OTH-Gold reports while a JSAF bridge (JLVCDT)** generated TADIL-J detentions.

- **Track management** occurred to correlate the various tracks at the GCCS server called **TOPCOP**.

Multinational Federation
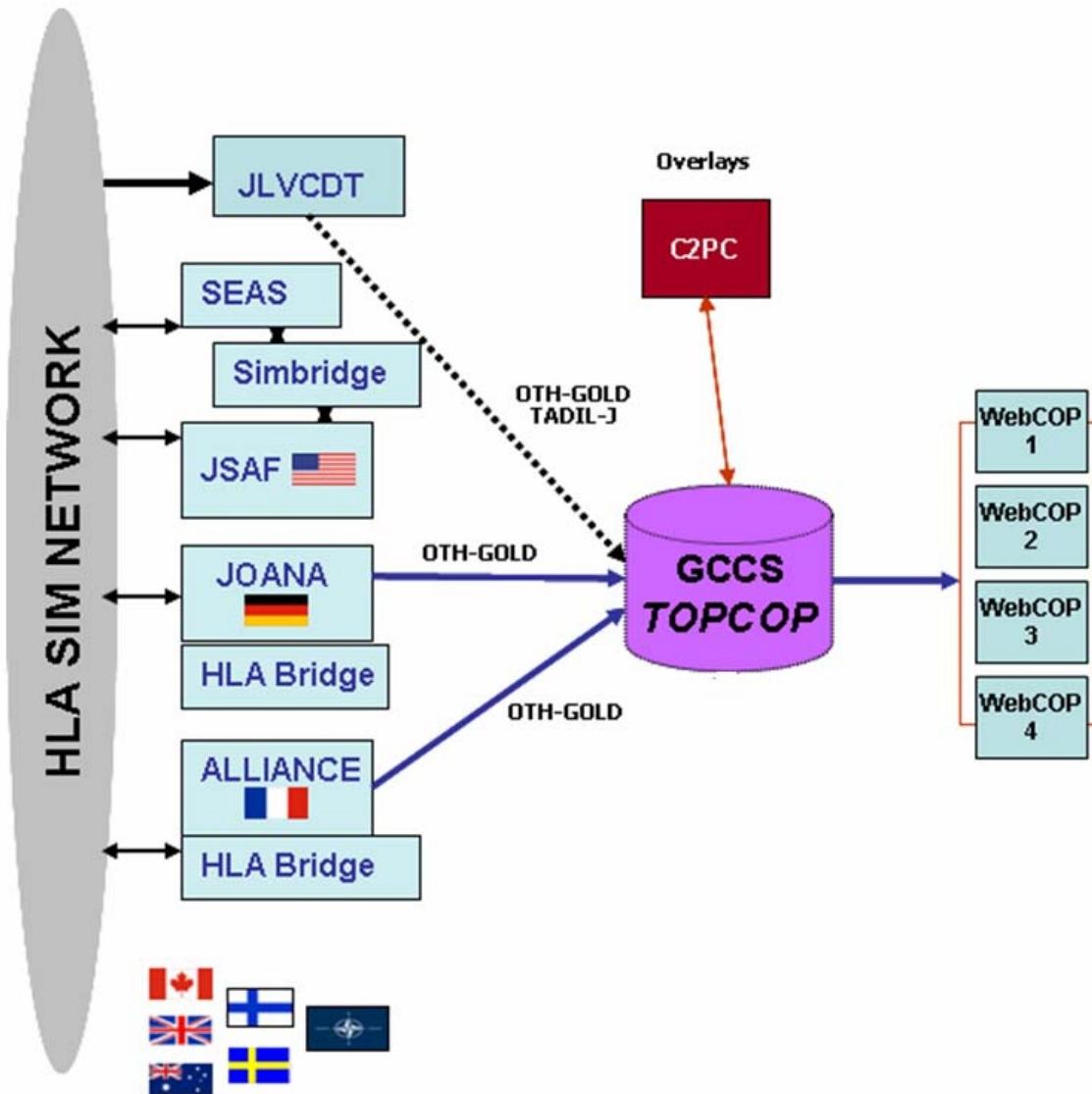
Exchanging Commander's Intent

- **MNE4 simulations sent free text message associated with the reporting features of the respective simulation entities .**

- **JSAF implemented this feature after the operator fills out the mission attribute option via the JSAF Plan View Display (PVD).**

- **JSAF orders assigned to a simulation entity were passed as free text messages through the JLVCDT to become viewable in the GCCS/WebCOP remarks field of the respective track.**

- **ALLIANCE and JOANA had a similar capability to report commander's intent via their respective bridges to GCCS.**

- **These free text messages were viewed as a means to communicate commander's intent via the C4ISR displays which were stimulated by the M&S .**

Exchanging Commander's Intent
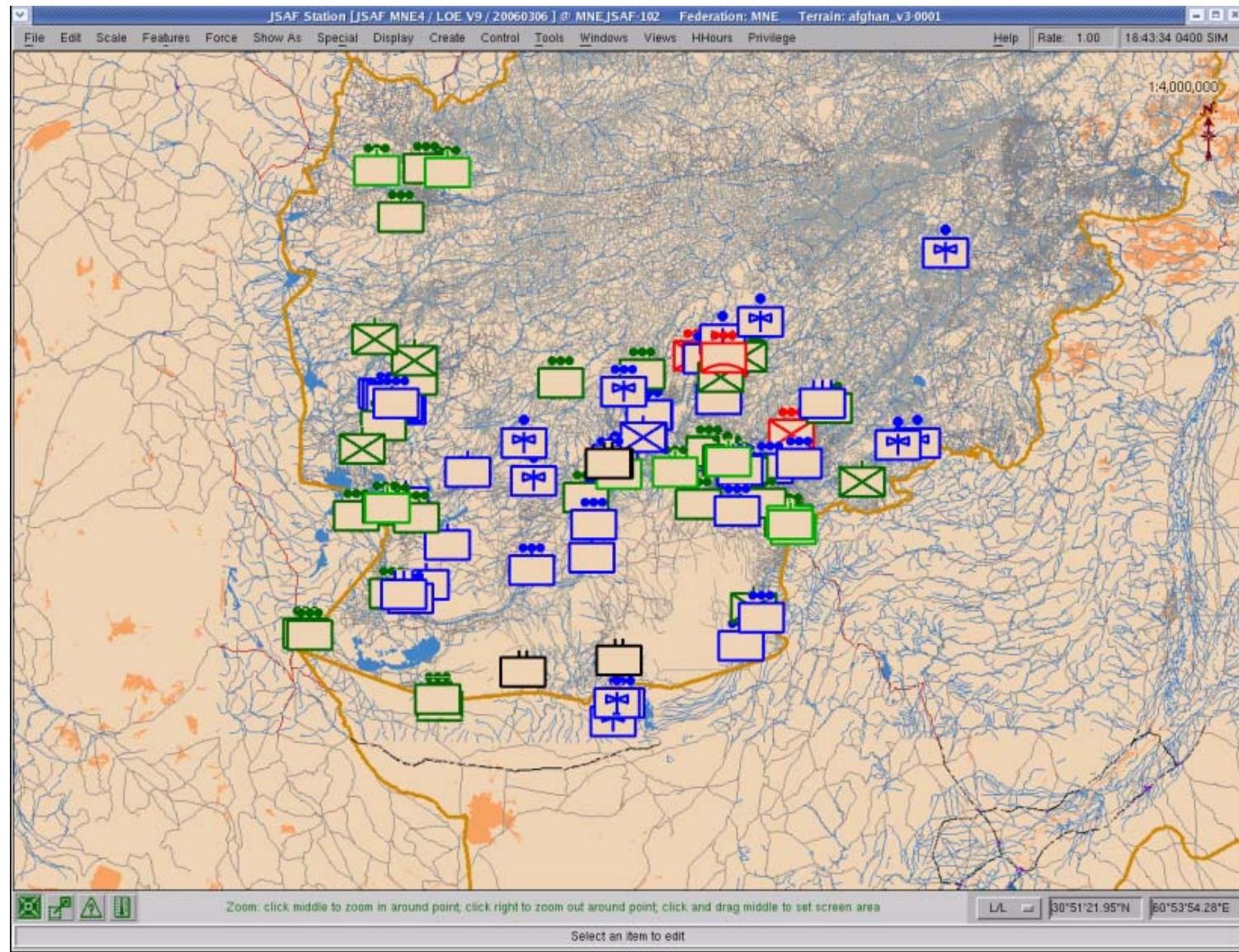
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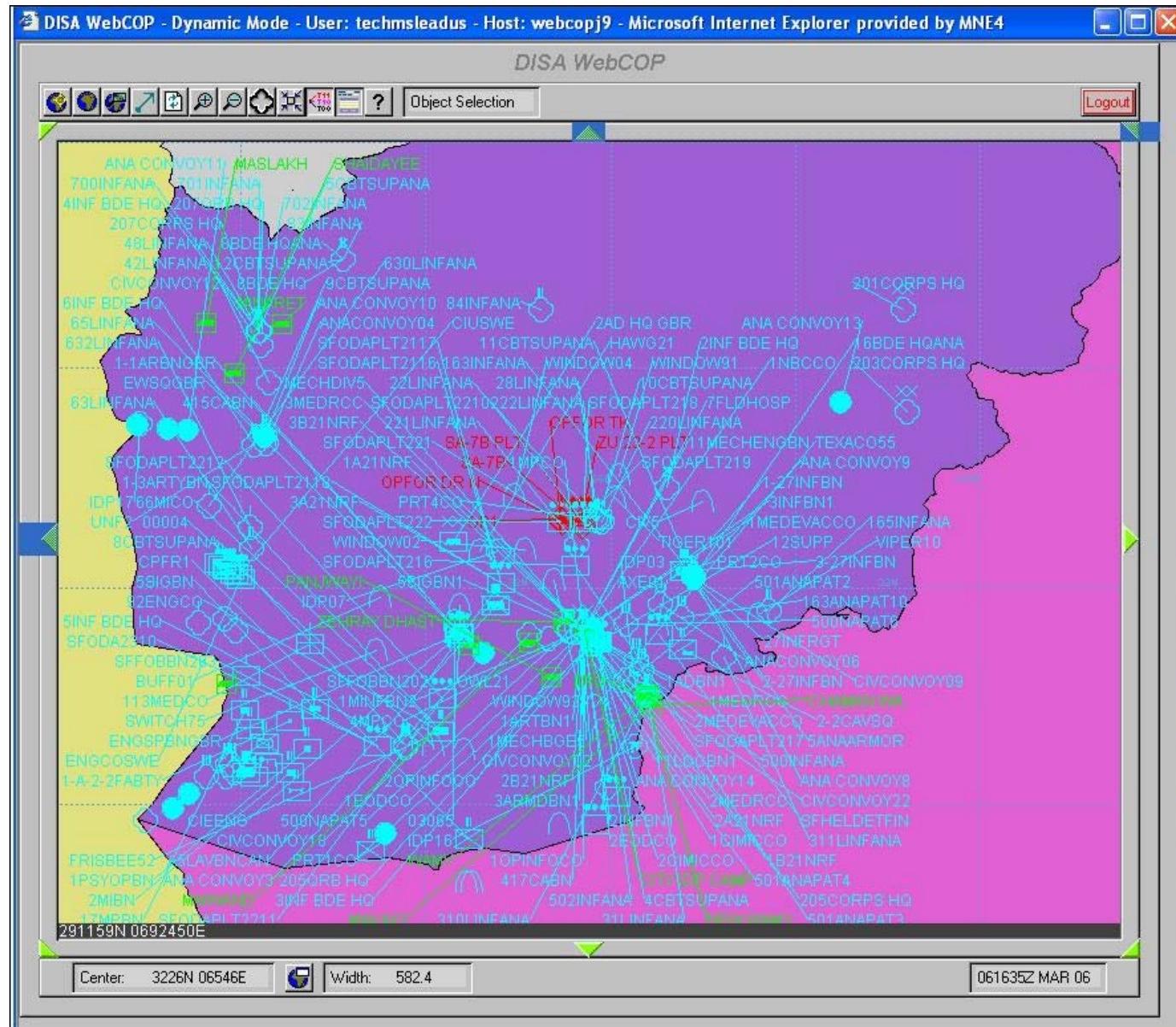
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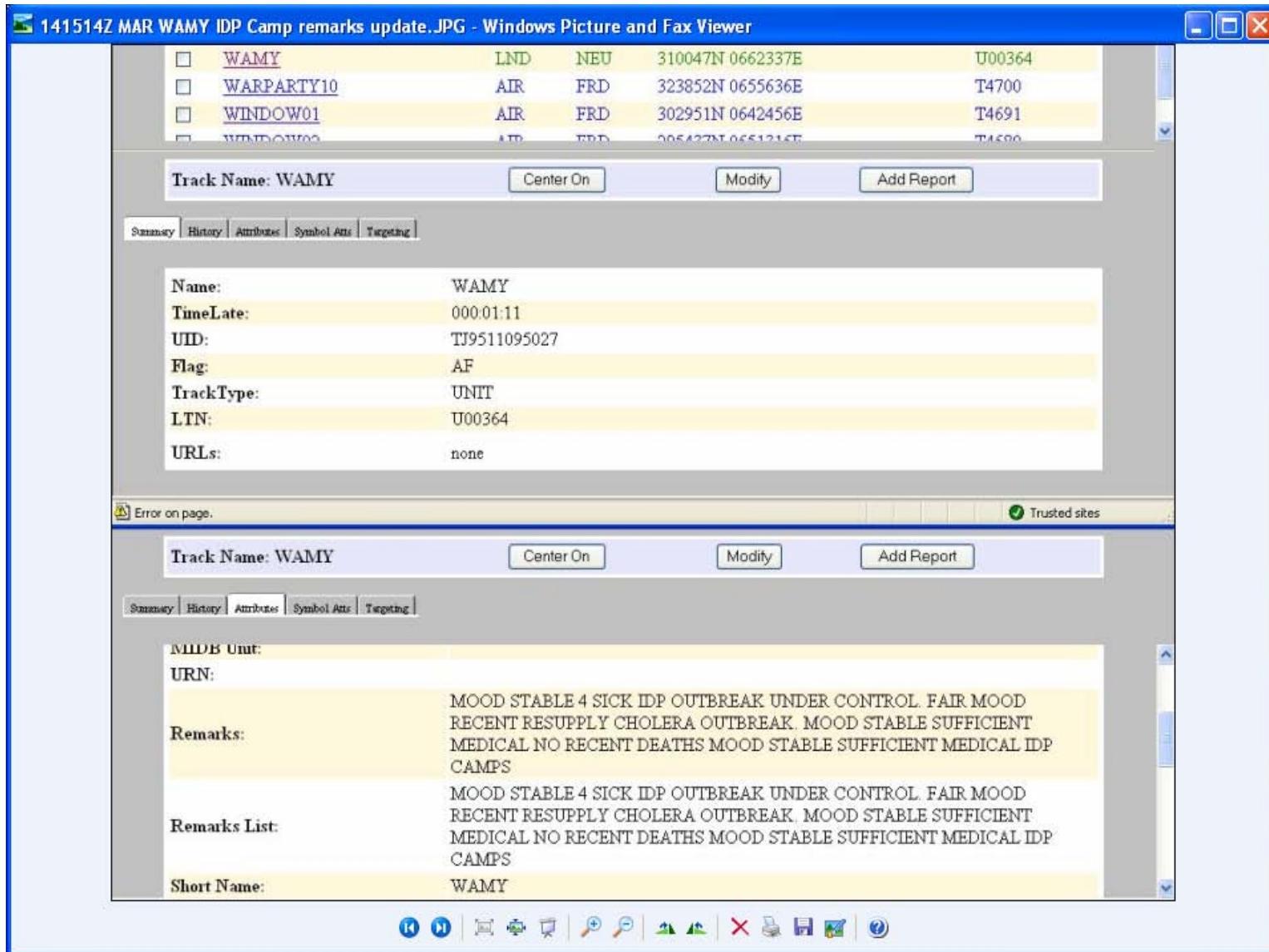
Future Work

- **Potential to do more complex population modeling by providing a means to relate an insurgent population's characteristics to the number of human generated intelligent reports, and the impact of leaders on the general public mood.**

- **Extending the refugee and displaced persons camp representations in JOANA to allow regional leaders to be influenced by the media's reporting of the perceived camps' frustration level based on shortages.**

- **Combine the capabilities of the JC3IEDM and Coalition –Battle Management Language , the resultant may actually evolve into a multinational knowledge base of the future.**

- **Serve as a standard to allow other technologies canvas the world's media and C4ISR sources to dynamically capture cultural information.**

Conclusions

- **Agent-Based simulations** may be useful to evolve the **taxonomy** of the JC3IEDM to further the advancement of JC2 IERs.

- Proposed extensions to the JC3IEDM can tie **commander's intent to tracks** in a web-enabled C4ISR environment, and help to assist in **visualizing regions** that non-kinetic effects are occurring.

- **Normality indicators** not currently support by current day C4ISR systems can be investigated using M&S to help identify and prioritize, and the JC3IEDM has the extensibility to support these investigations.

- JC3IEDM can assist in evolving **multinational knowledge bases**.

- A closer **relationship between M&S and C4ISR** can assist in evolving systems that provide greater SA/SU for the warfighter, and the JC3IEDM may help to foster that tie leading us closer to the realization of a **GIG enabled environment**.